Conjugated Polymer Networks

Christoph Weder, Case Western Reserve University, DMR-0215342

This research program focuses on the investigation of semiconducting conjugated polymer networks. We were able to show that the introduction of conjugated cross-links between conjugated macromolecules can significantly improve the charge transport characteristics of these materials, but due to the network structure, their processing is usually intricate. We have now demonstrated that this problem can be overcome by synthesizing such polymers in the form of cross-linked particles, which are processed as aqueous dispersions. Exploiting that a variety of metal-catalyzed cross-coupling reactions are tolerant to the presence of water, we prepared cross-linked conjugated polymer particles by polymerization of aqueous macro- micro- and miniemulsions. The size of the resulting polymer particles could be readily tuned over a wide range (mm to nm) via the reaction conditions, and it appears that the approach is broadly applicable for many conjugated polymer systems.

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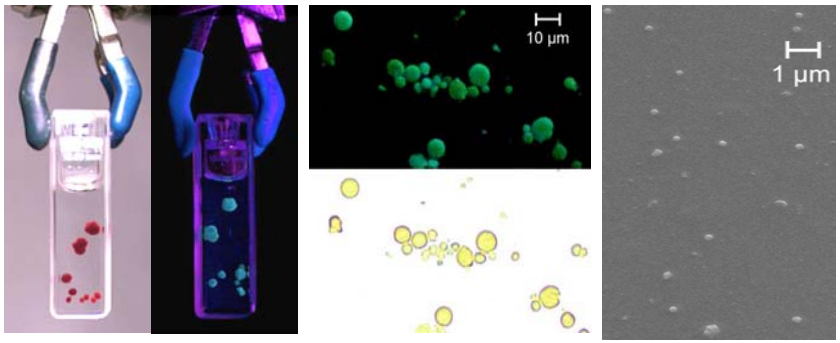

Cross-linked conjugated polymer milli- (left), micro- (center) and nanoparticles (right).

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Education:
So far, this grant has provided support for one Ph.D. student (Akshay Kokil) and three undergraduate students (Ms. Susan Given, Mr. Peter Yao, Mr. Dale Wilger).

Outreach:
The grant enabled the PI to implement a new outreach program in collaboration with the Cleveland Museum of Natural History. The activity expands the Museum's "Winter Discovery Day", an annual event in a city-wide celebration of Dr. Martin Luther King Jr. and his commitment to education. The event is free, in order to encourage especially economically disadvantaged families to visit the City's educational institutions and explore their resources. With the help of (under)graduate students and postdocs PI Weder and Case colleague S. Rowan created a mix of mini-lectures, poster displays, demonstrations, and hands-on activities that were designed to be fun, educational, and to showcase the importance of polymers in people's lives. About 650 visitors of all ages participated in the 20 minute polymer show.

Graduate student Brent Crenshaw explains the similarity of building blocks and Gummi Bears.